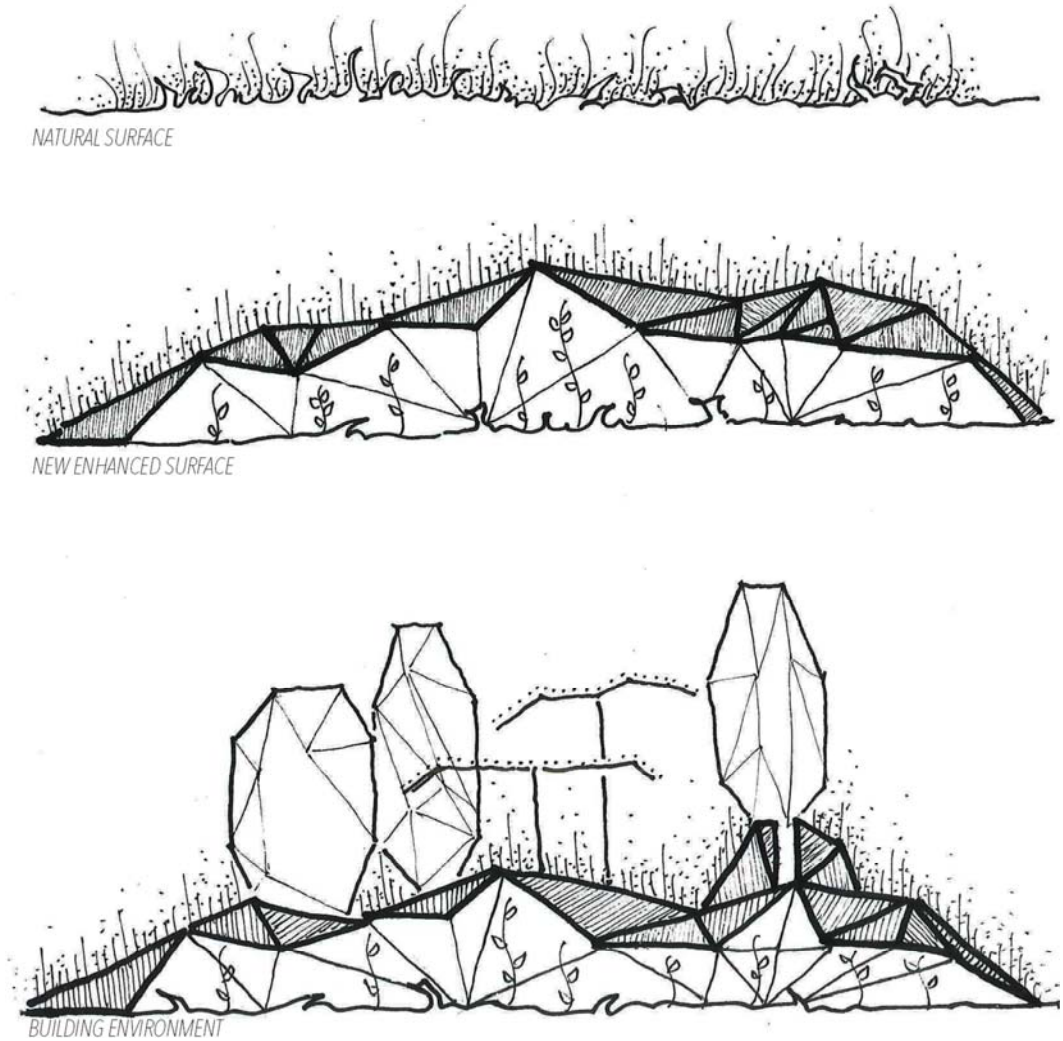
Architectural and Media Studies

S.M.A.R.T Environments: “The Interactive Surface”



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Introduction

Project: “the interactive surface”

The project is located in the Green Village which currently functions as a research site. The main design objective for the project is to built three-thousand square meters of student accommodations. Next to the student accommodations, space will be made available for small urban farms, study and work spaces, hospitalities and multifunctional spaces. In order to accommodate the program, an extra surface is added to the site. This newly added surface combined with the existing surface will facilitate the added program. The student accommodations will be placed on top of surfaces. Although all surfaces have their functions, it is to be expected that the spaces won’t be fully occupied at all times. To solve this problem the newly added surface will be made kinetic.

Kinetic surfaces

A kinetic surface, which can alter in shape and size, is placed in order to maximize the usage of the spaces. The surface will also be optimized on environmental components in order to optimise comfort within the spaces and to maximize the energy collected from the environment.

Research question

On what way and on which matter will it be possible to make a kinetic surface? What will the computational design strategy be to cope with the demands of this kinetic surface?

Goal

The goal of this report is to gain more knowledge about kinetic surfaces and to formulate a computational design strategy which could support the design process of the project.

S.M.A.R.T. Environments

Interconnection of society with technology

Advancements in computing powered technology and analytic tools made it possible to give computing powered systems attributes as empathy and compassion. Computing powered technology is already embedded in many household appliances as dishwashers, microwaves, ovens etc. On a larger scale computing powered technology is integrated into SMART Homes, which facilitates health and social care systems to patients. These examples of computing integrated technology shows that there is an undeniably strong relationship between mankind and computing systems. Therefore, it can be said that there is a need to distribute computing powered technology and a will to interconnect the society with technology to satisfy the demands of mankind. One of the advancements of computing powered technology led to the creation of S.M.A.R.T. Environments.

S.M.A.R.T. Environments

S.M.A.R.T. is an abbreviation for Systems and Materials in Architectural Research and Technology. S.M.A.R.T. Environment focuses on the intelligent inter-connection of resources and their collective behaviour. S.M.A.R.T. Environment is used for Performance Driven Architecture and Real-Time Interactive Environments. It covers the materials, computations, products and installations, buildings and cities. Based on information, environments are able to communicate with people, activities and environmental components in an intelligent matter. As a consequence, it enhances the users comfort and makes it possible to optimize designs based on activities or environmental components.

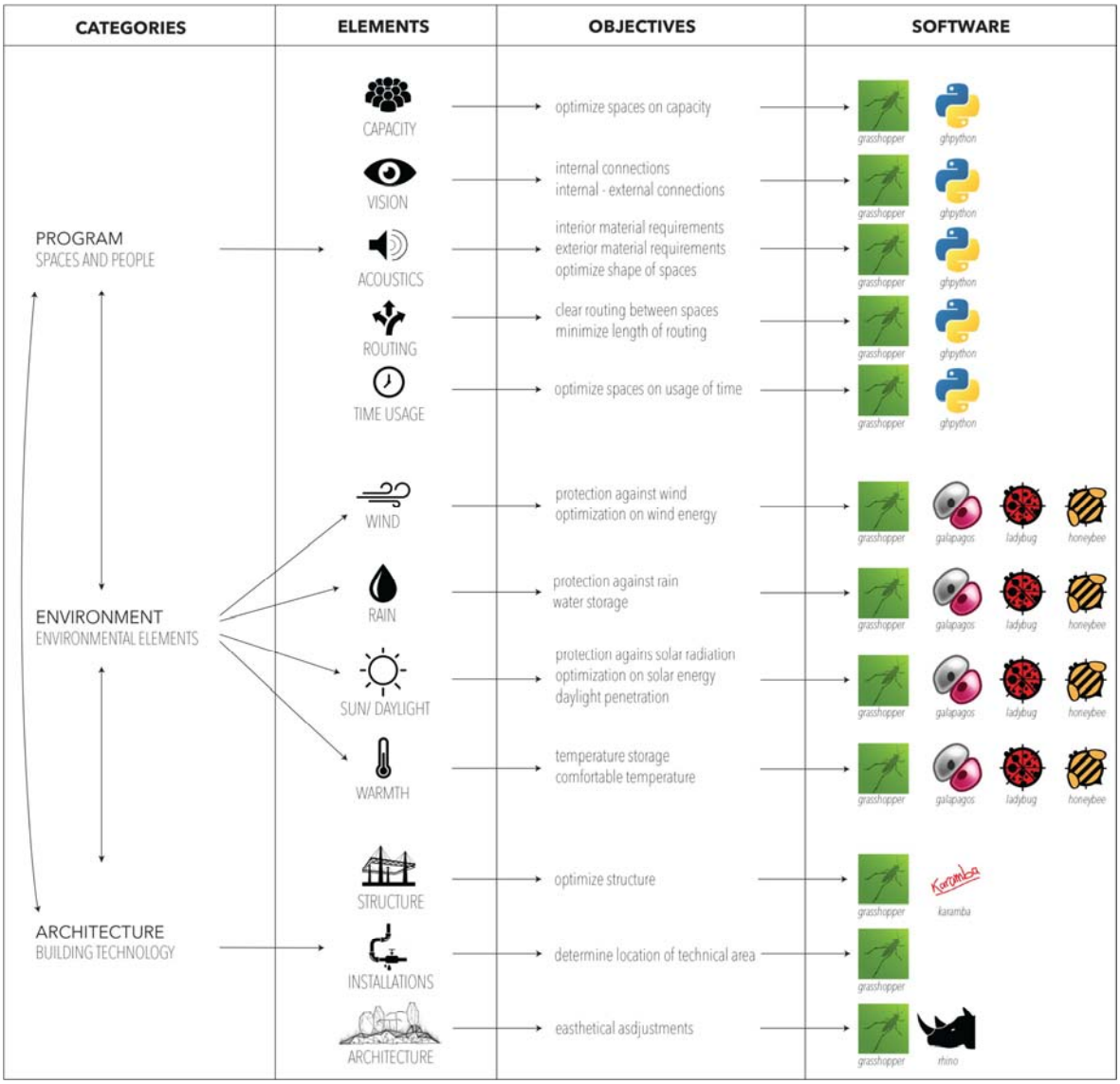
Digitally driven architecture through sensor technology

The S.M.A.R.T. Environments most often use sensor technology to gather data. After the data is collected it will be distributed towards actuators which makes it possible to create kinetic elements. Sensor technology has developed tremendously in recording and sharing information, learning from its own performance and interaction it will be able to make its own decisions. Thanks to digitally-driven architecture, it is possible for structures to be reconfigurable to the human needs by investigating evocative and emotive relations with the built environment. Cook describes the value of sensor technology in one of his books “Environments can provide constant small adjustments based on sensor readings and can better customize behaviours to the nuances of the inhabitants surroundings” (Cook, 2007, page 6).

S.M.A.R.T. Environments in project

The kinetic surface from our project will contain sensors and actuators. The sensors will collect data about users, program and environmental components and the actuators will make the surface kinetic. The data that will be collected will become the source for conceptualization, operation and production. The design will be process oriented and the usage of space will become time based.

Computational Design Strategy



The strategy is to implement sensors and actuators. The sensors will gather information and make predictions about the programming components to create a basic volume. This volume will be optimized due to the environmental and structural components. All gathered data from the sensors will be implemented into an architectural design. After the building is completed it will gather real-time information on which the actuators will react and change the shape of the spaces within the boundaries of the predetermined architectural concept.

Conclusion and reflection

Conclusion

Thanks to the developments made in computing powered technology such as S.M.A.R.T. Environments it is possible to implement gathered data into a design. Actuators and real-time sensor technology will make surfaces kinetically adjustable. The interaction between technology and its environment has an undeniable amount of importance and will no doubt be a necessity in the future of architecture.

Implementation of workshops and research into design process

This research shows that it is possible to make surfaces adjustable on gathered information. This knowledge added great value to the development of the project. The workshops also added great value to the design process. Especially the optimization workshop in where the shape of a skin was optimized to maximize the inlet of the sunlight. Thanks to the workshops and research it was possible to set up a design strategy which enhances the feasibility of the project.

Discussion on individual lectures and design process

In the lecture of Areti Markopoulou about a design for the Responsive City Areti claims that architecture is transforming into an organism which would be able to interact in real time with its environment or to the user. This statement comes close to the idea that we have of our project. The interaction between architecture and its users is an very important aspect in our design. This interaction will, in my eyes, be very important to the future of architecture to suit the increasingly user demands. The idea that we have in our project to maximize the usage within each space through the adaptability of each space according to its capacity. This idea suits the lecture of Architectural Geometry and Social logic of space by Shajay Bhooshan who claimed that the digitization of spatial architecture and intelligence augmentation of designers is a necessity on the path to a superior design intelligence. These two lectures suits the ideas that we have in our project the most. The idea of biological structures contradict our structures as we will use robotically enhanced materials rather than biological structures because we want to have more control over the adaptability of the surface.

Usefulness of research

The good thing is that through this research and thanks to the workshops I now know it is possible to make a kinetic skins and it also gave me a basic understanding of how kinetic systems can work. Another positive thing is that the design strategy should make it able to realize a computer-based model in which the adaptability of the project is shown.

Recommended follow-up study

Further research into S.M.A.R.T Environments, actuators and sensor technology is required to understand the limitations and properties of kinetic surfaces.

References

Aarts, E., & Wichert, R. (2009). Ambient intelligence. In Technology Guide (pp. 244-249). Springer Berlin Heidelberg.

Augusto, J. C. (2009, January). Past, present and future of ambient intelligence and smart environments. In International Conference on Agents and Artificial Intelligence (pp. 3-15). Springer Berlin Heidelberg.

Bier, H. H., & Knight, T. (2010). Digitally-driven architecture. Footprint: Delft School of Design journal,(6).

Bier, H., & Knight, T. (2014). Data-driven design to production and operation. FOOTPRINT, 8(2), 1-8.

Cook, D., & Das, S. (2004). Smart environments: Technology, protocols and applications (Vol. 43). John Wiley & Sons.

Oosterhuis, K. (Ed.). (2012). Hyperbody: First Decade of Interactive Architecture. Jap Sam Books.